

The Sphaeriidae (Bivalvia) from northwestern Argentina including three new species of *Pisidium*

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ABSTRACT

Knowledge on the Sphaeriidae fauna in southern South America is significantly improved with the description of three new species of the genus *Pisidium* from Salta and Jujuy provinces (northwestern Argentina). This paper provides the first record of sphaeriids in restrictive high-altitude South American environments, particularly from very small water courses found in “vegas”, exceptionally localized areas of “cushion vegetation” or “cushion peat bogs” developing between 2000–4000 m altitude in the Argentine pre-Andean ranges. Furthermore, the geographic distribution range of *Pisidium chiquitanum* Ituarte, 2001, only reported to date from the type locality in sub-Andean regions of central Bolivia, is considerably enlarged.

INTRODUCTION

The Sphaeriidae fauna from Argentina is poorly known; the first reports were those by Strobel (1874) on *Musculium argentinum* (d'Orbigny, 1835) and Pilsbry (1911) describing several new species of *Pisidium* C. Pfeiffer, 1821, and *Musculium* Link, 1807, from Patagonia. Later on, Doello-Jurado (1921) described the first species of *Eupera* Bourguignat, 1854, from Argentina, and Ituarte (1989, 1994) and Ituarte and Dreher-Mansur (1993) described three new species of *Eupera* from Ignazú, Uruguay and Paraná River basins in northeastern Argentina. Regarding the species diversity of *Pisidium* C. Pfeiffer, 1821, twelve species are known from Patagonia and Northeastern provinces (Ituarte, 1996, 1999, 2000).

Only two species of Sphaeriidae have been reported from northwestern Argentina: *Sphaerium lauricochae* (Philippi, 1869), from Jujuy Province (Ituarte, 1995) and *Musculium argentinum* from Mendoza Province (Strobel, 1874). The species diversity of *Pisidium* has essentially not been documented. In the present paper, three new species of *Pisidium* from lowland and high-altitude habitats in the pre-Andean mountain ridges are described. Based on new

findings the knowledge on the geographic distribution of *Pisidium chiquitanum* Ituarte, 2001, is updated.

MATERIALS AND METHODS

Materials for the present study were obtained during three field trips to Northwestern Argentina (Tucumán and Salta provinces in March 1999, Salta and Jujuy provinces in December 2001 and March 2004, and Catamarca Province in March 2004). Figure 1 shows the location of collecting sites; more detailed information on the source of specimens is given in the Systematics section. The collected specimens were fixed immediately after collecting in 70% alcohol after being relaxed through a short rinse (around 20 seconds) in warm water (about 50°C). Specimens for scanning electron microscopy (SEM) were cleaned by repeated rinsing in distilled water followed by a short treatment (about 5 seconds) in 10% sodium hypochlorite solution. Soft anatomy was studied after decalcification of valves through a 12-hour rinsing in a 5% formaldehyde and 2% acetic acid solution. Linear measurements (shell length [SL], shell height [SH], shell width [SW] and presiphonal suture length [PSS]), shape indices and morphometric ratios (height index [HI = SH/SL], convexity index [CI = SW/SH], ratio of hinge length [HiL] to shell length [HiL/SL]), were calculated according to the criteria followed by Ituarte (1996). For each calculation ($n = 10$, unless otherwise stated), mean and standard deviation values are given.

Type specimens are deposited at Museo de La Plata, La Plata (MLP), Museo Argentino de Ciencias Naturales “Bernardino Rivadavia”, Buenos Aires (MACN), Fundación Miguel Lillo, Tucumán (FML) and Muséum National d'Histoire Naturelle, Paris (MNHN). Types of *Pisidium chiquitanum*, housed at Museo de Historia Natural “Noel Kempff Mercado”, Santa Cruz de La Sierra, Bolivia (MHNB) and MLP were also used for comparative purposes.

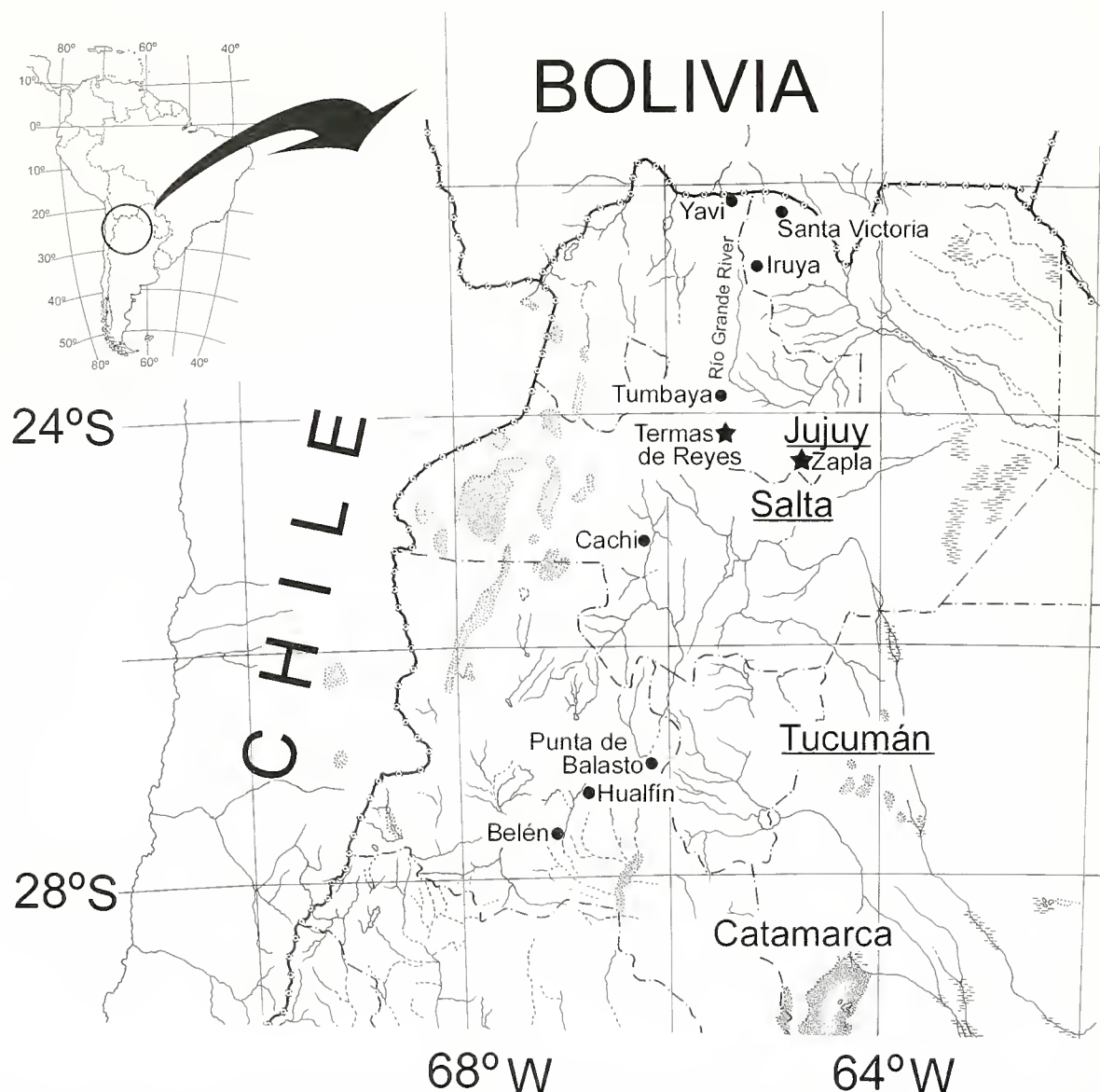


Figure 1. Location map. Stars in black indicate type localities of *Pisidium omaguaca* new species, *Pisidium oclaya* new species, and *Pisidium chicha* new species.

SYSTEMATICS

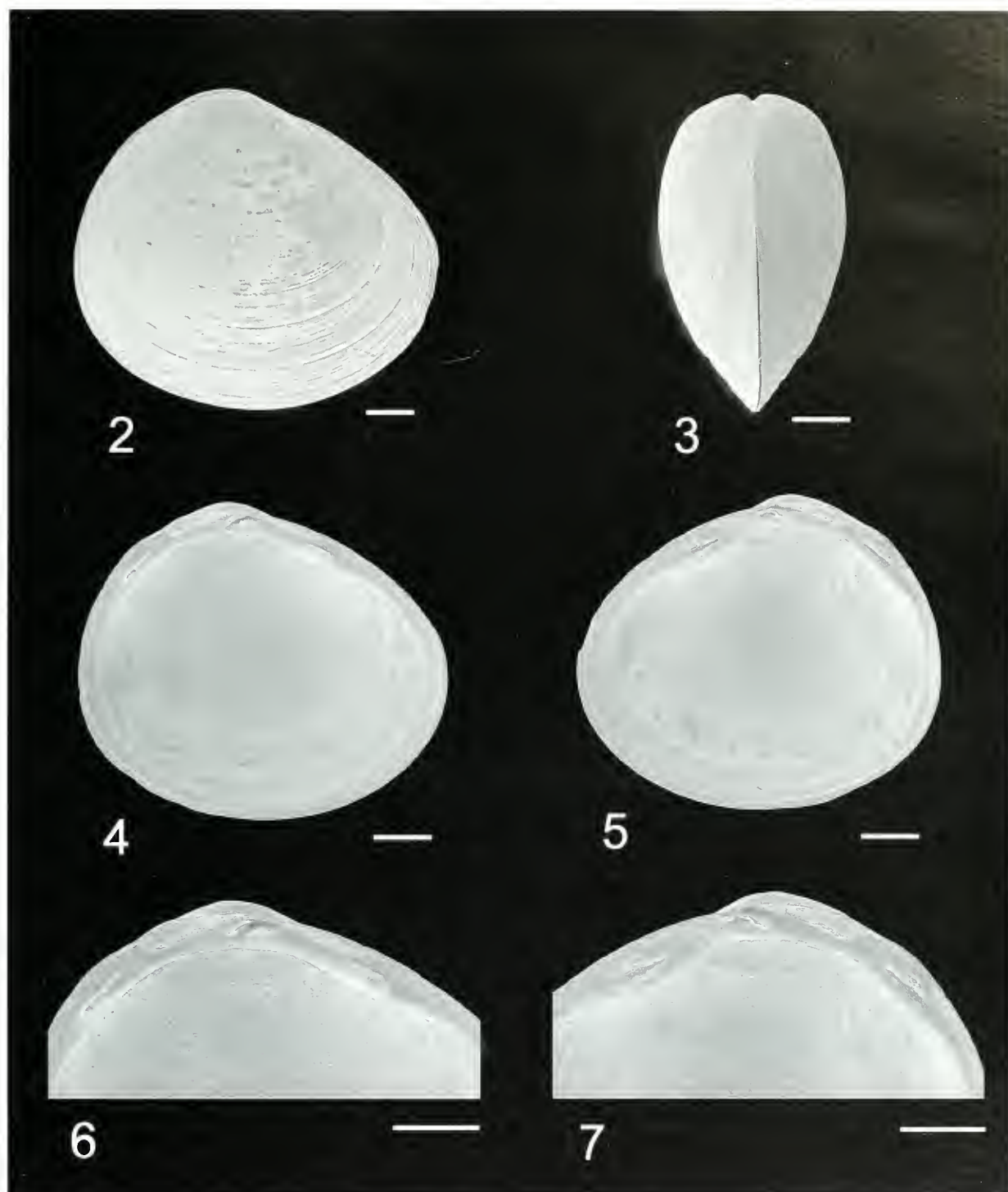
Pisidium omaguaca new species (Figures 2–15)

Diagnosis: Shell markedly oval, high and anteriorly produced, beaks depressed, displaced backward, not projecting from shell surface and only barely visible above dorsal margin; ligament internal; anal and branchial mantle openings present; two demibranchs present, nephridia of closed type, with lateral lobe not visible in lateral or dorsal views.

Description: Shell thin, translucent, small to medium size (mean SL = 2.73 ± 0.17 , maximum observed size: 3.7 mm), rather high (mean HI = 85 ± 1) (Figure 2), not inflated (mean Ci = 58 ± 3) (Figures 2, 3). Shell

outline markedly oval, anteriorly elongated. Anterior end produced in a sharp curve, posterior end short, widely rounded, sometimes slightly truncated and straight (Figures 2, 4, 5, 8). Dorsal margin short, weakly connected with anterior margin, which slopes markedly towards anterior end; sometimes, a gentle angle marks joining point of dorsal and posterior margins (Figure 8). Beaks very low, depressed and wide, not raised from shell surface, only slightly projected above dorsal margin, displaced backward, located at about 59% of SL (Figures 2, 4, 5). Shell surface finely and somewhat irregularly striated, glossy, amber.

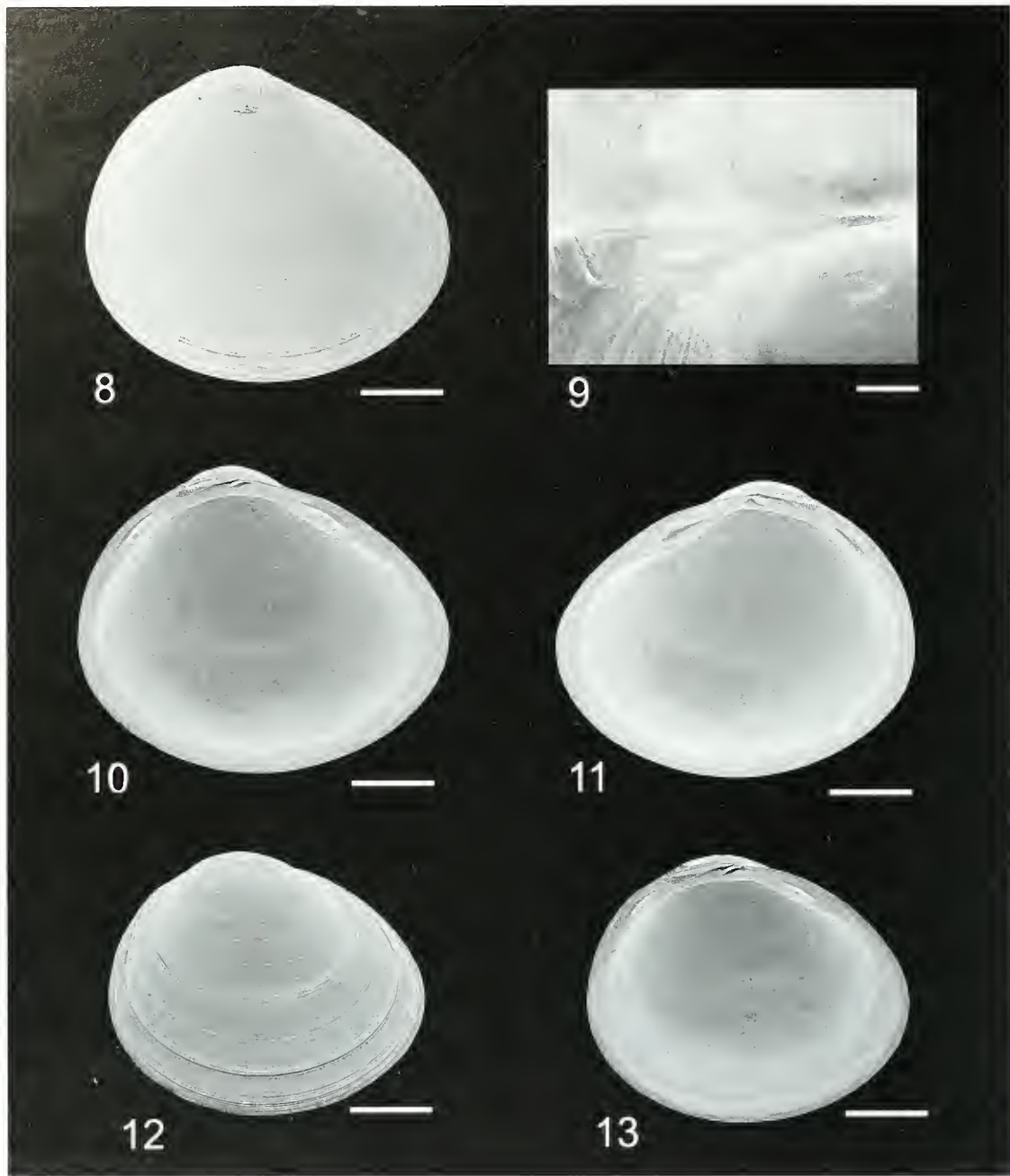
Hinge plate strong, hinge line short (HI/SL = 53 ± 3), strongly curved. Hinge: Left valve (Figures 4, 6): cardinal teeth well-developed, the inner one (C₂) thin, short at base, bent upward, slightly oblique with respect



Figures 2–7. *Pisidium omaguaca* from Termas de Reyes, Jujuy. **2.** Holotype (MLP 5496-1-1): outer view of right valve. **3–7.** Paratypes (MLP 5496-1-2). **3.** Posterior view. **4.** Left valve, inner view. **5.** Right valve, inner view. **6.** Left valve, detail of hinge. **7.** Right valve, detail of hinge. Scale bars = 500 μ m.

to antero-posterior axis, rounded at the tip, outer cardinal tooth (C_4) a narrow, slightly wider at posterior end, uniformly curved blade, quite oblique, overlapping C_3 at posterior half; anterior lateral tooth (AII) very strong, short, nearly straight, cusp high, pointed.

displaced forward; posterior lateral tooth (PII) minute, straight and strong, cusp high, distally displaced. Right valve (Figures 5, 7): cardinal tooth (C_3) not strong, somewhat displaced forward, curved in the middle, quite narrow at anterior half, slightly enlarged in a posterior,



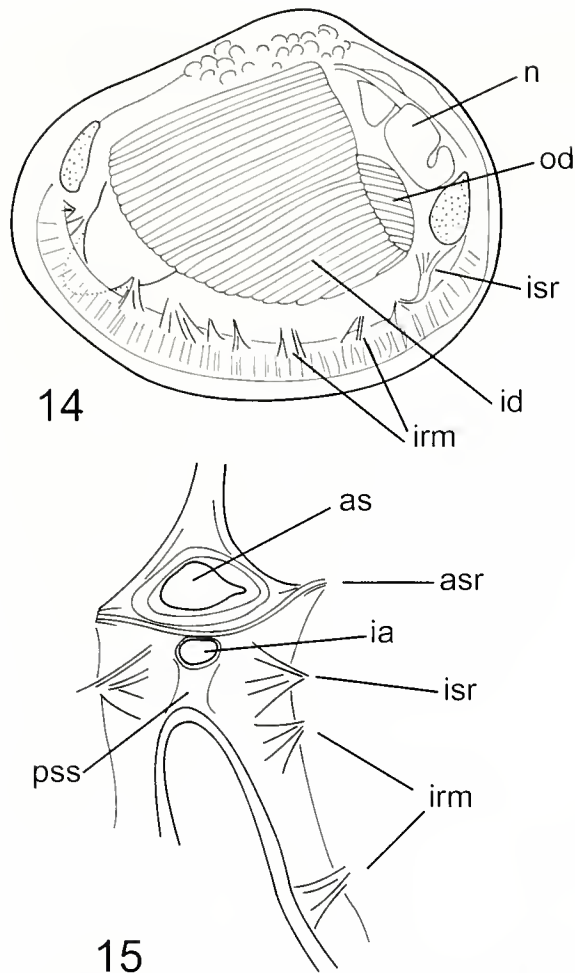
Figures 8–13. *Pisidium omaguaca*. **8.** Paratype (MLP 5485). Right valve, outer view. **9.** Paratype (MLP 5496-1-2). Dorsal view, detail of the escutcheon. **10–11.** Inner view of left and right valves of a specimen from Tiraxi, Jujuy (MLP 6535). **12, 13.** Outer and inner views of right and left valves of a specimen from a “peat bog” between Yavi (Salta) and Santa Victoria (Jujuy) (MLP6559). Scale bars (**8, 10–13**) = 1000 μ m; (**9**) = 200 μ m.

elongated cup. Lateral teeth short and robust, inner anterior lateral (AI) curved, cusp subcentral or slightly displaced anteriorly; outer anterior lateral tooth (AII) quite short, cusp distal; inner posterior lateral (PI) nearly straight, short, cusp subcentral; outer posterior lateral (PII) minute, with distal cusp.

Ligament-pit enclosed, deep, inner margin straight or slightly concave (Figures 6, 7). Ligament relatively short, representing $20 \pm 1\%$ of shell length, strong, internal,

never visible from outside (Figure 9). Escutcheon inconspicuous (Figure 9).

ANATOMY: Anal siphon and branchial inhalant mantle opening present. Presiphonal suture about 9% of shell length (Figure 15). Eight or nine well-marked muscle scars located away from pallial line correspond to inner radial mantle muscles. Muscle scars corresponding to anal siphon retractors are coalescent with that of



Figures 14–15. *Pisidium omaguaca* new species. **14.** Gross anatomy. **15.** Mantle muscles. (as: anal siphon; asr: anal siphon retractor; ia: inhalant aperture; id: inner demibranch; isr: inhalant siphon retractor; irm: inner radial mantle muscles; n: nephridium; od: outer demibranch; pss: presiphonal suture).

posterior adductor muscle (Figures 4, 5). Bundles of fibers of inner radial mantle muscles strong, converging anteriorly, except for two posterior bundles (Figures 4, 5, 14).

Inner and outer demibranchs present. Outer demibranch much smaller, formed by 10–12 very short descending filaments, reaching back to the 14th filament of inner demibranch (Figure 14). Up to three large embryos (1.3 mm length) were found within each brood pouch of a specimen 3.7 mm L. Nephridia of closed type, dorsal lobe, usually subquadrate, completely covering pericardial part of nephridium (Figure 14).

Type Locality: A small watercourse opening into Reyes River at Termas de Reyes, 24°10'19" S, 65°29'27" W, 1754 m altitude, Jujuy Province, Argentina (Figure 1).

Type Material: Holotype (MLP 5496-1-1) and 42 paratypes from the type locality (16 paratypes MLP 5496-1-2; 6 paratypes MLP 5485; 4 paratypes MACN-In

36361; 12 paratypes FML 14506; and 4 paratypes MNHN).

Other Material Examined: Jujuy Province: numerous specimens from the type locality (MLP 5496-1-3); Tumbaya, small pool with vegetations at the side of national road No. 9 (23°47'28" S, 65°28'37" W), 2070 m (MLP 6548); small stream flooding from springs in highland areas covered with "cushion vegetation", between Yavi (Jujuy) and Santa Victoria (Salta) (22°07'11" S 65°13'05" W), 4150 m (MLP 6559); small pool at the side of Río Grande River (22°58'14" S 65°27'01" W), 3950 m (MLP 6530); small springs at side of Manzanito Rivulet, near Huertas (22°14'20" S 65°00'31" W), 2740 m (MLP 6551); small stream at the side of the road to Yala (24°07'20" S 65°24'16" W), 1430 m (MLP 6531). Salta Province: unnamed brook on provincial road No. 57, near Cachi (25°05'24" S 66°07'33" W), 2340 m (MLP 6540).

Distribution: Highlands of Jujuy and Salta provinces, Argentina, between 1400 and 4100 m altitude.

Etymology: The name refers to the Omaguacas, ancient aboriginal inhabitants of the Quebrada de Humahuaca, the spectacular 150 km long valley of the Río Grande River (Figure 1), which underwent a major cultural change during the past 10,000 years.

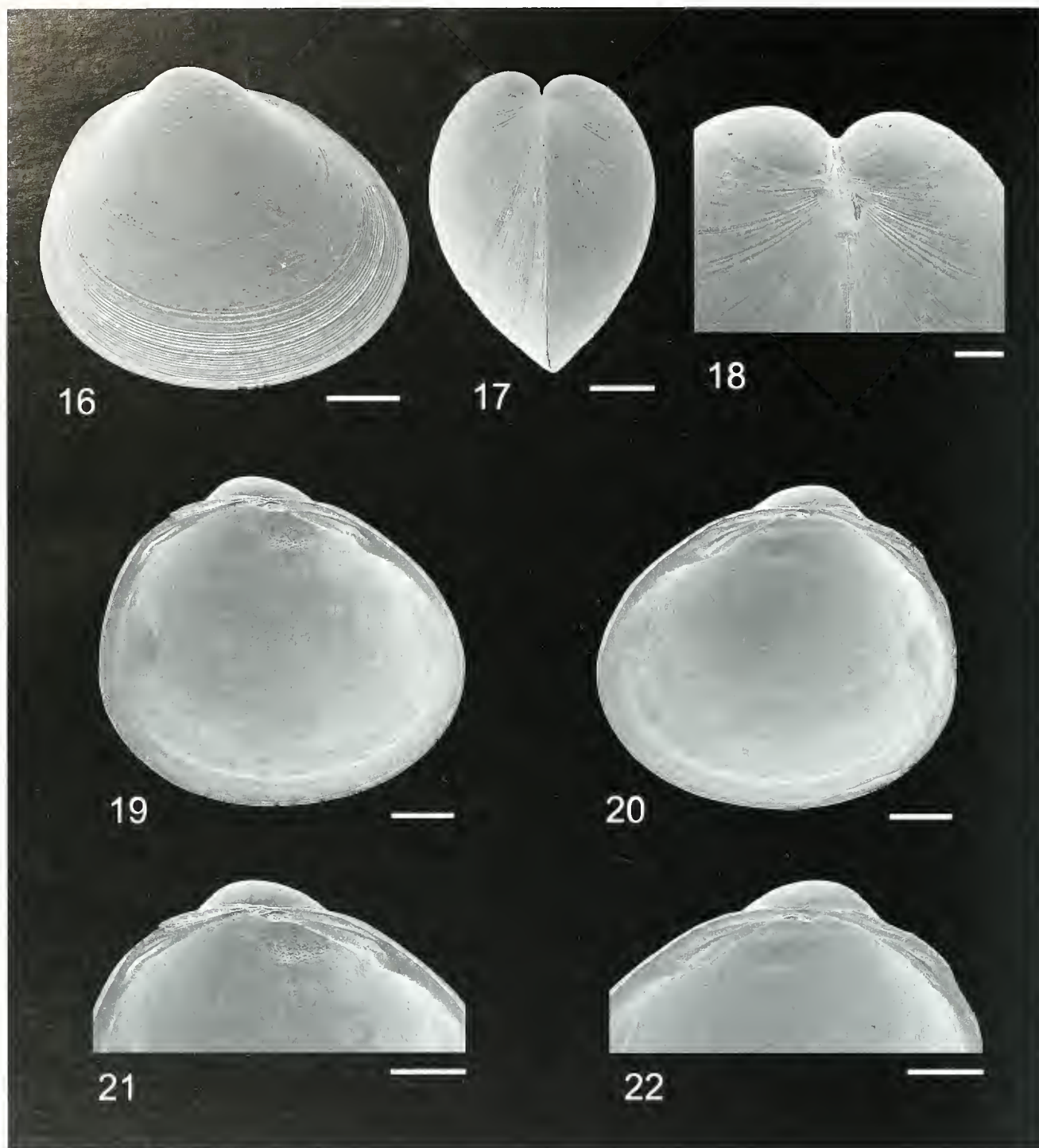
Remarks: *Pisidium omaguaca* new species differs from *Pisidium mcierbrooki* Kuiper and Huiz, 1984, in being higher and less obese, having lower and not inflated beaks, and a more broadly rounded posterior end. *Pisidium omaguaca* new species is similar to *Pisidium chiquitanum* Ituarte, 2001, in soft anatomy, but differs in having a more solid and higher shell, with posterior end shorter and anterior half of dorsal margin sloping markedly towards the anterior end.

Pisidium oclaya new species
(Figures 16–33)

Diagnosis: Shell rather trapezoidal and high, small size, presence of only one (anal) mantle aperture and one demibranch.

Description: Shell thin, translucent, of small to medium size (maximum observed SL = 3.2 mm), high (mean HI = 85 ± 2), quite convex (mean CI = 77 ± 4), shell outline rather trapezoidal. Anterior end somewhat produced in a sharp curve, posterior end short, truncate, somewhat oblique (Figures 16, 17). Beaks full, wide at base, markedly raised from shell surface and projected above dorsal margin, subcentral or slightly displaced backward, located at about 58% of SL (Figures 16, 19, 20). Shell surface finely and irregularly striated (Figures 16, 18), glossy, whitish or yellowish.

Hinge plate not strong, narrow in middle, hinge line rather long (HI/L/SL = 56 ± 2), arcuate. Hinge on right valve (Figures 20, 22); cardinal tooth (C₃) delicate,



Figures 16–22. *Pisidium oclaya* new species from Burrumayo River, Jujuy. **16.** Holotype (MLP 5499-1): outer view of right valve. **17–22.** Paratypes (MLP 5499-2). **17.** Posterior view. **18.** Posterior view, detail of ligament. **19.** Left valve, inner view. **20.** Right valve, inner view. **21.** Left valve, detail of hinge. **22.** Right valve, detail of hinge. Scale bars (16, 17, 19–22) = 500 μ m; (18) = 200 μ m.

rather weak, slightly curved, narrow on anterior half, enlarged into a well-marked, blunt, posterior cup. Lateral teeth robust, inner anterior lateral (AI) well-developed, cusp displaced distally; outer anterior lateral tooth (AII) shorter and weaker, cusp distal; inner

posterior lateral (PI) gently curved, not long, cusp distally displaced; outer posterior lateral (PII) reduced in size, with distal cusp. Hinge on left valve (Figures 19, 21); cardinal teeth minute, inner one (C_2) short and high, horizontal with respect to antero-posterior axis,

outer one (C_4) short, oblique, slightly overlapping C_2 at posterior end; anterior lateral tooth (AII) very strong, cusp high, distal; posterior lateral tooth (PII) shorter and weaker, cusp high, distal.

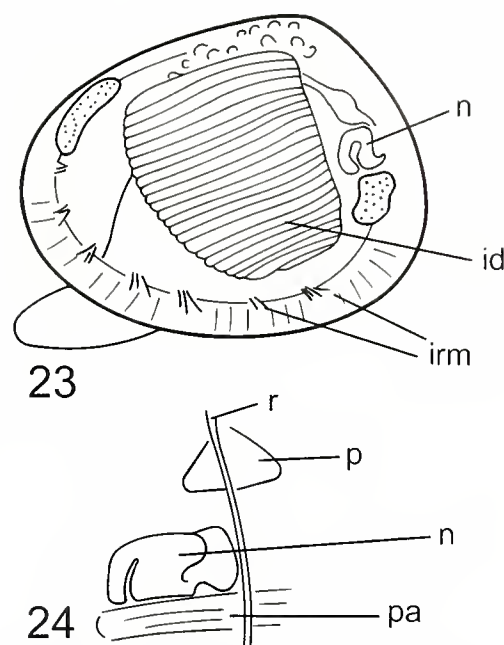
Ligament-pit enclosed, deep, inner margin slightly and evenly curved (Figures 21, 22). Ligament narrow, relatively long, representing $24 \pm 1\%$ of shell length, visible from outside and somewhat protruded at anterior half of ligament length. Escutcheon slightly marked by a delicate lanceolate line (Figures 17, 18).

ANATOMY: Only one demibranch (inner) present (Figure 23). Only anal mantle opening present. Inner radial mantle muscles weak, 6–7 bundles of few weak fibers converging anteriorly, attached just above pallial line (Figure 23); sometimes scars corresponding to inner radial muscles coalescent with pallial line (Figures 19, 20). Anal siphon retractors attached immediately ventrally to posterior adductor muscle. Nephridium with lateral loop visible dorsally (Figure 24).

Type Locality: Small flooded areas on the banks of Burumayo River ($24^{\circ}10'18''$ S, $65^{\circ}22'43''$ W), 1201 m altitude, in the neighborhood of Jujuy City, Jujuy Province, Argentina; and unnamed brook opening into Zapla River ($24^{\circ}16'03''$ S, $65^{\circ}07'09''$ W), 946 m altitude, Zapla, Jujuy Province, Argentina.

Type Material: Holotype (MLP 5499-1) and 15 paratypes from the outskirts of Jujuy City (6 paratypes MLP 5499-2; 10 paratypes FML 14505; 56 paratypes from Zapla (36 paratypes MLP 6899-2; 10 paratypes MACN-In 36362; 10 paratypes MNHN).

Other Material Examined: Catamarca Province: unnamed brook at national road No. 40 at La Ciénaga de Abajo, between La Ciénaga and Belén ($27^{\circ}31'05''$ S, $66^{\circ}59'08''$ W), 1520 m (MLP 7201); Jujuy Province: numerous specimens from the type locality (MLP 7369); unnamed brook on side of provincial road No. 4 at Guerrero ($24^{\circ}11'13''$ S, $65^{\circ}26'51''$ W), 1650 m (MLP 7379); small spring on side of provincial road No. 4, near Termas de Reyes ($24^{\circ}10'36''$ S $65^{\circ}28'18''$ W), 1730 m (MLP 5497-1, MLP 7370-1); small water course on side of national road No. 9 at Tumbaya ($23^{\circ}51'26''$ S, $65^{\circ}27'57''$ W), 2020 m; Los Cedros Rivulet, south to "El Carmen" ($24^{\circ}28'0''$ S $65^{\circ}17'08''$ W), 1190 m (MLP 6545-1); small spring near Tiraxi ($23^{\circ}59'57''$ S, $65^{\circ}19'39''$ W), 1576 m (MLP 6553); on the road between Termas de Reyes and Laguna Yala, flooded areas at the bottom of hills ($24^{\circ}07'47''$ S, $65^{\circ}28'58''$ W), 1920 m (MLP 7371). Salta Province: unnamed brook at national road No. 40 at Molinos ($25^{\circ}18'53''$ S, $66^{\circ}14'58''$ W), 2155 m (MLP 6526); small spring at road No. 33 to Cachi at Los Laureles ($25^{\circ}06'27''$ S, $65^{\circ}36'10''$ W), 1360 m (MLP 6529); Tucumán Province: flooded areas at side of the Nío River, near Río del Nío City ($26^{\circ}25.60'$ S $64^{\circ}55.60'$ W), 886 m (MLP 7403); on side of Medina River, on provincial road No. 305, between El Típal and Aserradero (MLP 7404-1); small



Figures 23–24. *Pisidium oclaya* new species. **23.** Gross anatomy. **24.** Detail of nephridium. (**id**: inner demibranch; **irm**: inner radial mantle muscles; **n**: nephridium; **p**: pericardium; **pa**: posterior adductor; **r**: rectum.

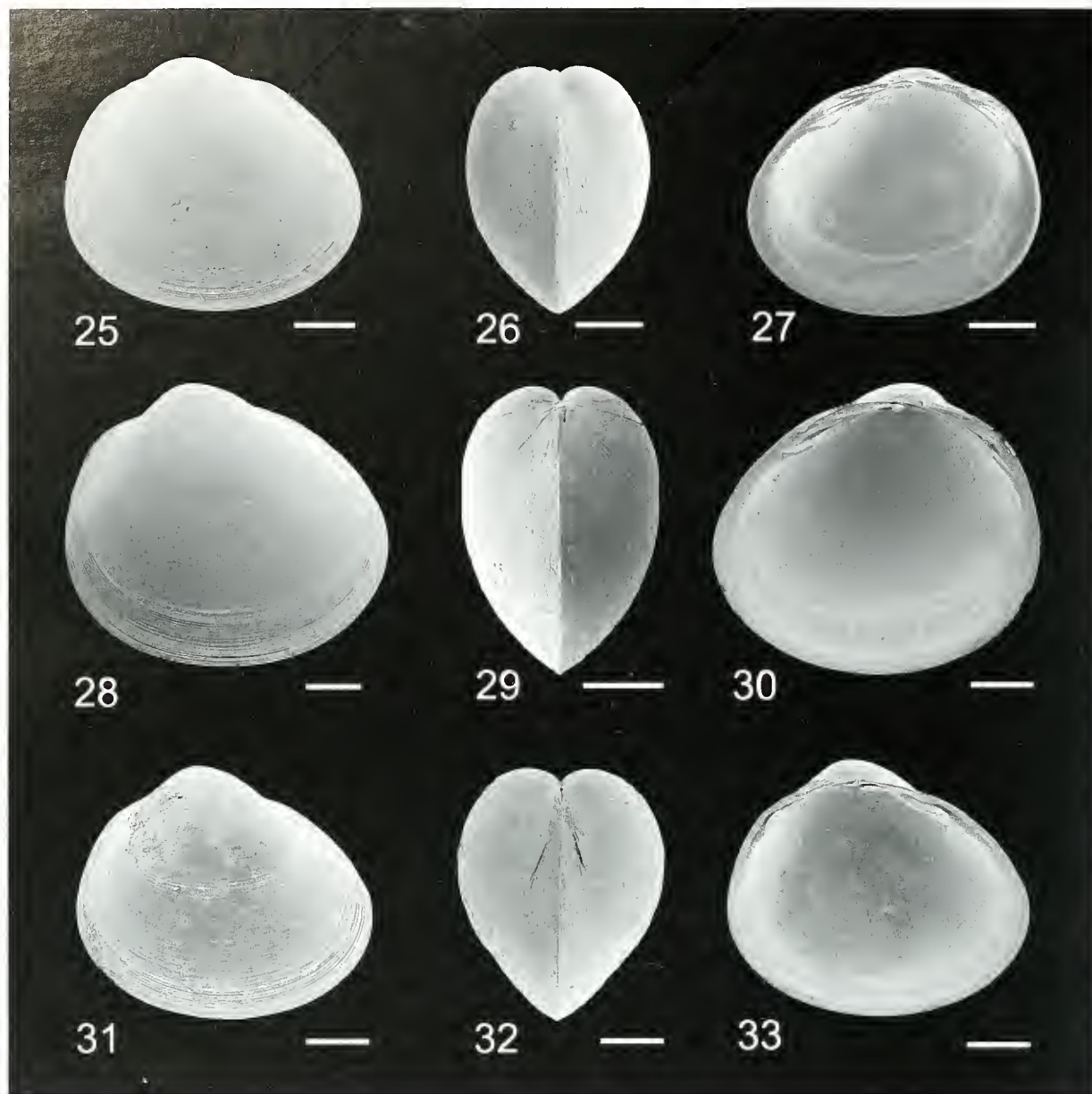
pond on side of Potrero de Las Tablas River, Raco, 880 m (MLP6992), La Angostura dam, on Los Sosa River ($26^{\circ}55'21''$ S, $65^{\circ}41'02''$ W), 2000 m (MLP 6897-2).

Distribution: Catamarca, Jujuy, Salta, and Tucumán provinces, Argentina, between 880 and 2155 m altitude.

Etymology: The name of the new species refers to the Ocloyas, ancient aboriginal inhabitants of the lands in the surroundings of the type locality.

Remarks: *Pisidium oclaya* new species strikingly differs from other northwestern Argentine *Pisidium* species by its relatively small size and trapezoidal shell outline. Compared with *Pisidium vile* Pilsbry, 1987, a small species from the eastern drainage system of the Río de La Plata Basin, *P. oclaya* new species differs in being larger and comparatively lower. Ituarte (1999) described *Pisidium huillichum* from southern Chile, another small-sized *Pisidium* species with one mantle opening and one demibranch, which differs from *P. oclaya* in having a non trapezoidal shell outline, lower beaks, very strong lateral teeth, and strongly marked commarginal ribs of the shell surface.

The height/length ratio, the convexity index and the degree at which part of the ligament is protruded showed a relatively wide variability in samples of *Pisidium oclaya* from different localities (Figures 25–33); larger specimens were in general more convex with much inflated and pronounced beaks, and more sharply defined trapezoidal outline.



Figures 25–33. *Pisidium oclaya* new species. **25–27.** Specimens from Termas de Reyes, Jujuy (MLP 5497-1). **28–30.** Specimens from Zapla, Jujuy (MLP 6899-2). **31–33.** Specimens from Cachi, Salta (MLP 6529). Scale bars = 500 μ m.

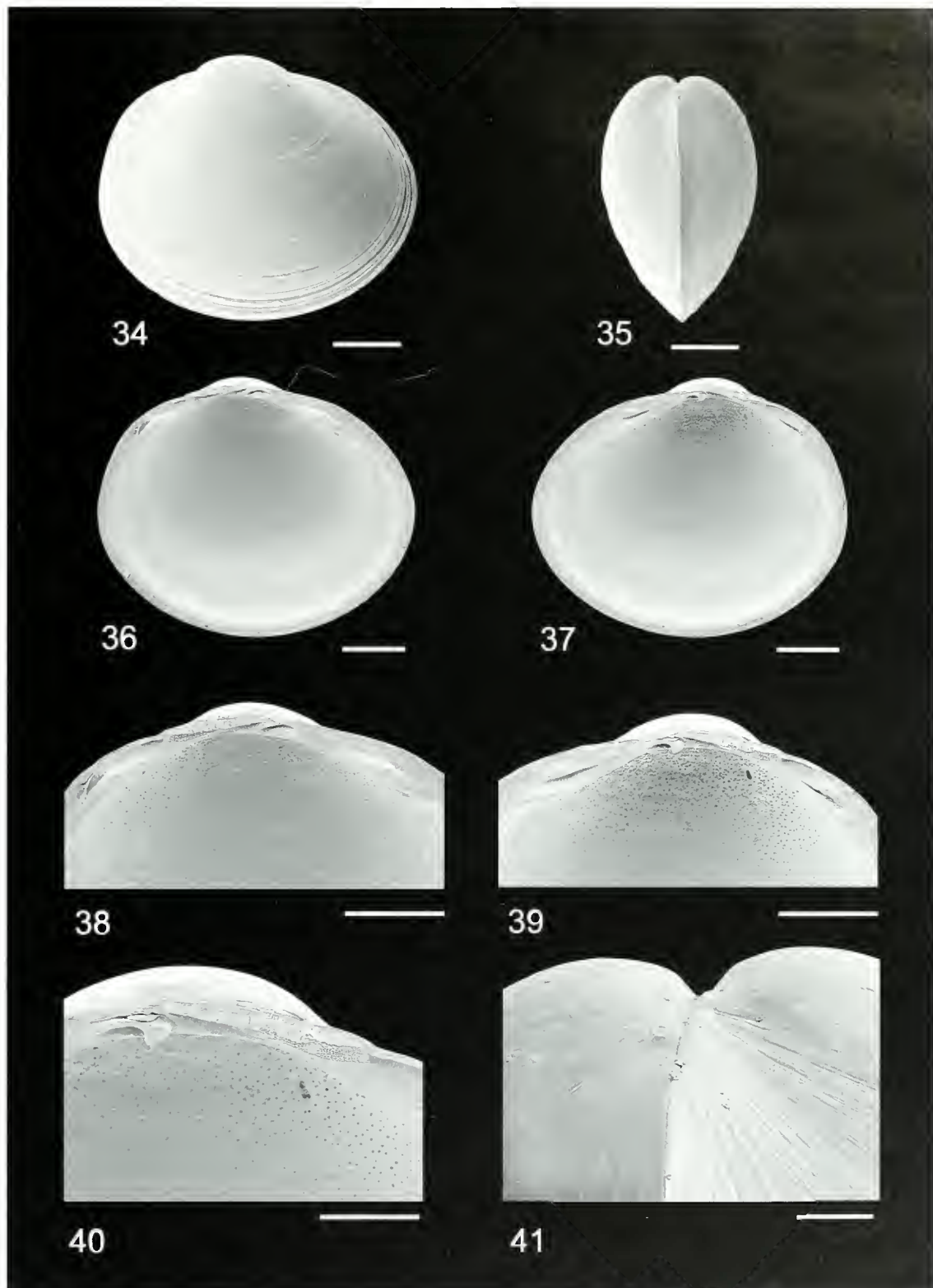
Pisidium chicha new species
(Figures 34–43)

Diagnosis: Rather elliptic shell outline, sub-centrally located beaks, somewhat inflated and markedly raised from shell surface, are diagnostic features. The presence of only one mantle aperture and one demibranch is also distinctive.

Description: Shell small, maximum observed shell length 2.7, moderately high (mean $HI = 79 \pm 1$), not convex (mean $CI = 68 \pm 5$); shell outline strikingly oval. Dorsal and ventral margins broad, dorsal margin, slightly arcuate, ventral margin uniformly curved; anterior end

evenly curve and only slightly projected forward, posterior end slightly truncated (Figures 34–37). Beaks wide, widely rounded at tip, somewhat inflated, raised above dorsal margin but low, sub-central, slightly displaced backward, located at about 57–58% of SL. Shell surface glossy, amber, sculptured with well marked fine and rather regularly spaced striae (Figure 34).

Hinge plate narrow, hinge line somewhat short, $HiL/SL = 53 \pm 3\%$ of SL ($n = 8$), widely curved. Hinge on left valve (Figures 36, 38): cardinal teeth well-developed, the inner one (C_2) thin, long, straight at base, bent upward distally, parallel with respect to antero-posterior axis, rounded at tip, outer one (C_4) a slender, slightly



Figures 34–41. *Pisidium chicha* new species. 34. Holotype (MLP 6S99-1-1): outer view of right valve. 35–41. Paratypes (MLP 6S99-1-2). 35. Posterior view. 36. Left valve, inner view. 37. Right valve, inner view. 38. Left valve, detail of hinge. 39. Right valve, detail of hinge. 40. Right valve, detail of cardinal tooth and ligament. 41. Posterior view, detail of ligament. Scale bars (34–37) = 500 μ m; (38, 39) = 200 μ m; (40) = 250 μ m; (41) = 100 μ m.

curved blade, quite oblique, overlapping C_2 on posterior half; anterior lateral tooth (AII) very strong, straight, cusp high, somewhat acute, displaced distally; posterior lateral tooth (PII) short, strong, cusp high, distal. Hinge on right valve (Figures 37, 39, 40): cardinal tooth (C_3) well-developed, narrow, and evenly curved on anterior half, quite enlarged into triangular, slightly grooved cup at posterior end; slightly hanging from inner margin of hinge plate. Lateral teeth short and robust, inner anterior lateral (AI) somewhat curved, cusp displaced forward; outer anterior lateral tooth (AIII) very short, straight, with distal cusp; inner posterior lateral one (PI) short, straight, slender and low, cusp sub-central; outer posterior lateral one (PIII) minute, with distal cusp.

Escutcheon lanceolate, long, outline demarcated by a very delicate line. Ligament-pit enclosed, inner margin gently sinuous (Figures 40, 41). Ligament moderately strong, internal, slightly visible from exterior, but not protruded, representing about 23% of shell length.

ANATOMY: Only one (anal) mantle opening present. Only inner demibranch present (Figure 42). Inner radial mantle muscles weak, inserted just above or coalesce with pallial line. Nephridium with dorsally visible lateral loop (Figure 43).

Type Locality: Unnamed brook flooding into Zapla River in the neighborhood of Zapla City (24°16'01" S, 65°07'09" W), 946 m altitude, Jujuy Province, Argentina, and small springs on bank of Manzanito Rivulet, on the road from Santa Victoria East to Yavi near Huertas (22°14'20" S, 35°00'31" W), 2740 m, Jujuy Province, Argentina.

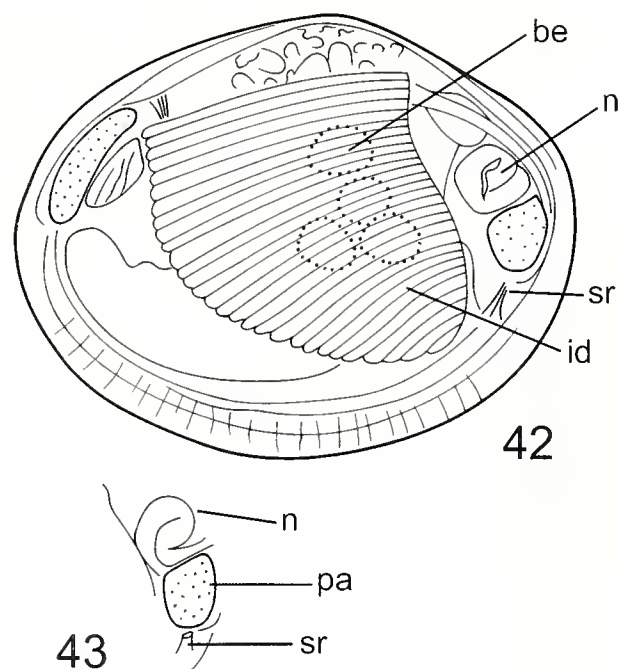
Type Material: Holotype (MLP6899-1-1), 9 paratypes (7 paratypes MLP 6899-1-2; 2 paratypes MACN-In 36363) from 24°16' S, 65°12' W; 62 paratypes from 22°14'20" S, 35°00'31" W (52 paratypes MLP 6550; 5 paratypes FML 14775; 5 paratypes MNHN).

Other Material Examined: Catamarca Province: flooded areas at side of an unnamed river on the road to Singuil, (27°38'25" S, 65°57'23" W), 2000 m (MLP7203). Jujuy Province: Los Cedros Rivulet, close to Las Maderas Dam (24°28'40" S, 65°17'08" W), 1190 m (MLP 6545-2). Tucumán Province: small pools at the side of Medina River, on provincial road 305 between El Típal and Aserradero (MLP 7404-2).

Distribution: Catamarca, Jujuy and Tucumán provinces, Argentina, between 940 and 2740 m altitude.

Etymology: The name of the new species alludes to the Chichas, a small ethnic group that was a part of the Omagnaca people, who inhabited the lands in the neighborhood of the type locality.

Remarks: The shell shape, quite ovate and nearly equilateral, and the marked sculpture of *Pisidium chicha* new species are distinctive features that allow for easy identification of the new species among other *Pisidium* species from northwestern Argentina. A moderate shell



Figures 42–43. *Pisidium chicha* new species. **42.** Gross anatomy. **43.** Detail of nephridium. (**be**: brooding embryos; **id**: inner demibranch; **n**: nephridium; **pa**: posterior adductor; **sr**: siphon retractor).

variation was observed: the specimens from Manzanito Rivulet (MLP 6550) show shells slightly more convex and higher than those of the specimens from Zapla (MLP 6899-1); the striae were slightly coarser and more marked in the former group. Specimens from Catamarca Province (MLP 7203) show slightly inequilateral shells, with posterior end slightly shorter. *Pisidium chicha* shares with *P. oclaya* the same number of mantle openings and demibranchs and the nephridium with lateral lobe dorsally visible; but the former species strikingly differs in having a smaller shell with quite an oval shell outline. The presences of only one demibranch and one mantle opening in *P. chicha* clearly separate this species from *P. chiquitanum*. In addition, this latter is a larger species of relatively similar shell outline but that also differs from *P. chicha* in having an almost smooth shell surface, lower, more backward displaced beaks, and somewhat truncated posterior end.

Pisidium chiquitanum Ituarte, 2001
(Figures 44–47)

Pisidium chiquitanum Ituarte, 2001: 50; figs. 2–14 (La Siberia, West of Comarapa, Santa Cruz de La Sierra, Bolivia, holotype MHNB 34734).

Diagnosis: Rather elongate shell outline, slightly truncated at posterior end, low and posteriorly located beaks, ligament position, internal but externally visible, presence of branchial and anal openings, two demibranchs on each side and nephridia of closed type.

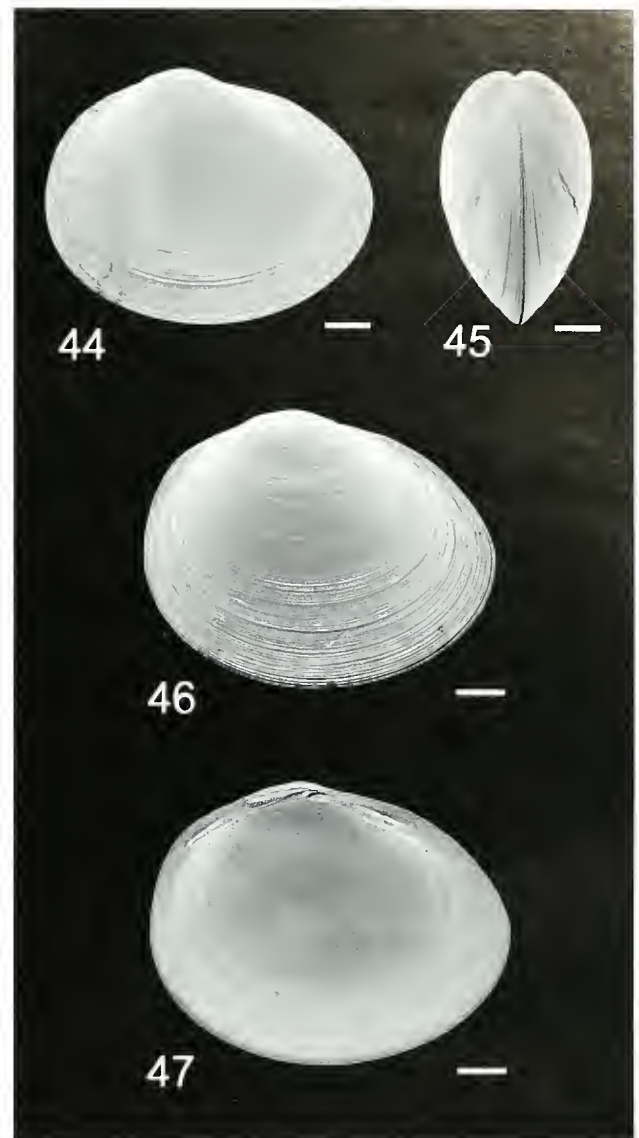
Description: Shell thin, small to medium size (mean $SL = 3.9 \pm 0.25$; maximum observed size: 4.2 mm), not very high (mean $HI = 80 \pm 1$), not convex (mean $Ci = 61 \pm 4$), shell outline markedly oval, elongate, anteriorly produced, posterior end short, widely rounded, or slightly truncated and nearly straight (Figures 44, 46, 47). Beaks low, depressed, slightly projected above dorsal margin, located at about 62% of SL (Figures 44–46). Shell surface dull glossy, straw-yellowish, with fine and low commarginal striae, moderately more accentuated towards the shell margin (Figures 44, 46).

Hinge plate solid, hinge line rather long ($HiL/SL = 56 \pm 2$). Hinge on right valve: Right cardinal tooth (C_3) strongly curved in middle, quite narrow on anterior half, enlarged into gently sulcated, rounded, or somewhat elongate cup. Right lateral teeth robust, inner anterior lateral (AI), widely curved, long, cusp sub-central or slightly displaced forward; outer anterior lateral tooth (AIII) quite short, cusp distal; inner posterior lateral (PI) nearly straight, short, cusp sub-central; outer posterior lateral tooth (PIII) reduced in size with distal cusp. Left valve (Figure 47): cardinal teeth short, inner one (C_2) short, oblique with respect to antero-posterior axis, outer one (C_4) a narrow curved lame, quite oblique, overlapping C_2 on posterior half; anterior lateral tooth (AI) strong, straight, cusp sub-central; posterior lateral tooth (PII) narrow and weak, cusp distal.

Ligament-pit enclosed, deep, inner margin slightly sinuous, concave at posterior end. Escutcheon well marked by a delicate line; ligament long, internal, but visible from outside in anterior half through a very narrow and sometimes rather long gap between valves, never protruded. Ligament length is $23 \pm 1\%$ of shell length.

ANATOMY: Anal siphon and branchial mantle opening present. Presiphonal suture rather long, representing $11 \pm 2\%$ of SL. Anal siphon well-developed, pair of powerful siphonal retractors present. Inner radial mantle muscles, S bundles as rule, inserted away from pallial line, scars of those corresponding to anal siphon retractors coalescent with posterior adductor muscle scars. Inner and outer demibranchs present. Outer demibranch reduced in size, composed of 11–15 very short descending filaments, reaching back to the 14–16th filament of inner demibranch. Nephridia of closed type, dorsal lobe variable in shape, commonly subquadrate, with lateral loop not visible in dorsal view.

Material Examined: Holotype (MHNB 34734) La Siberia, West of Comarapa, Santa Cruz de La Sierra, Bolivia; Tucumán, Argentina: $27^{\circ}01'24''$ S, $65^{\circ}39'29''$ W (MLP 6554); Cerro Muñoz, Santa Cruz, $26^{\circ}54' S$, $65^{\circ}46'42''$ W, 2400 m (MLP 6991); La Angostura dam, $26^{\circ}56' S$, $65^{\circ}41'03''$ W, 1800 m (MLP 6527); Jujuy, Argentina: Los Laureles, $25^{\circ}06'27''$ S, $65^{\circ}36'10''$ W, 1360 m (MLP 6528); Los Toldos, Santa Victoria Department, 1770 m (MLP 6993); small brook near Tiraxi ($23^{\circ}59'57''$ S, $65^{\circ}19'39''$ W), 1576 m (MLP 6552); small



Figures 44–47. *Pisidium chiquitanum* Ituarte, 2001. 44, 45. Paratype (MLP 5362). 44. Outer view of right valve. 45. Posterior view. 46, 47. Specimen from Tiraxi, Jujuy (MLP 6552). 46. Outer view of right valve. 47. Inner view of left valve. Scale bars = 500 μ m.

spring at the side of provincial road No. 4, near Termas de Reyes ($24^{\circ}10'36''$ S, $65^{\circ}28'18''$ W) (MLP 5497-2).

Distribution: Ranging from sub-Andean regions in Siberia (west of Comarapa) in central Bolivia (1800 m altitude) southward to northwestern Argentina (between 1360 and 2400 m altitude).

Remarks: *Pisidium chiquitanum* can be easily identified among South American *Pisidium* species by its oval shell outline with low beaks and internal (however visible from the outside) ligament. It is also characterized by two, inner and outer, demibranchs on each side, two siphonal openings, and nephridia of closed type.

Pisidium chiquitanum resembles *Pisidium meierbrooki* Kuiper and Hinz, 1984, from Peru and Bolivia, which is the only known species from tropical South America with both, branchial and anal, siphonal openings (Ituarte, 1995). *Pisidium meierbrooki* differs from *P. chiquitanum* in having a more convex shell (according to data in Kuiper and Hinz, 1984, the Ci varies between 77 and 80), fuller and more backward displaced beaks. As pointed out by Ituarte (2001) *Pisidium chiquitanum* is similar to specimens from Ecuador and Peru reported by Kuiper and Hinz (1984), as *Pisidium casertanum* (Poli, 1791), an Eurasian species extremely variable in shell shape, currently reported as cosmopolitan (Burch, 1975; Kuiper, 1983; Kuiper and Hinz, 1984; Holopainen and Kuiper, 1982). However, these specimens are larger than *P. chiquitanum*, having more central beaks and less produced anterior end. *P. chiquitanum* also differs from *P. casertanum* in having less convex shell, lower and narrower beaks, decidedly displaced backward. The specimens from northwestern Argentina slightly differ from the ones from Bolivia in being generally higher, with beaks slightly less displaced in posterior direction (Figure 46).

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